Can Biological Soil Crust Mosses be Developed as Restoration Materials on the Colorado Plateau? Hurdles and Outstanding Research Topics.

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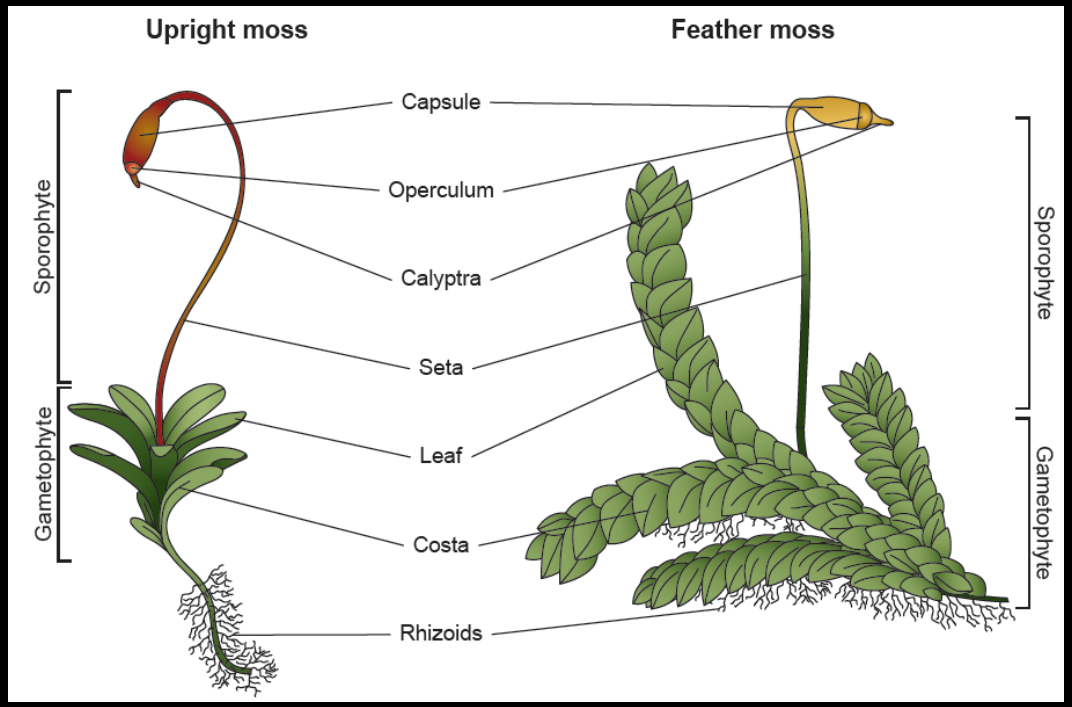
What you need to know about
moss biology in 3-4 slides….

Mosses: what are they….plants?



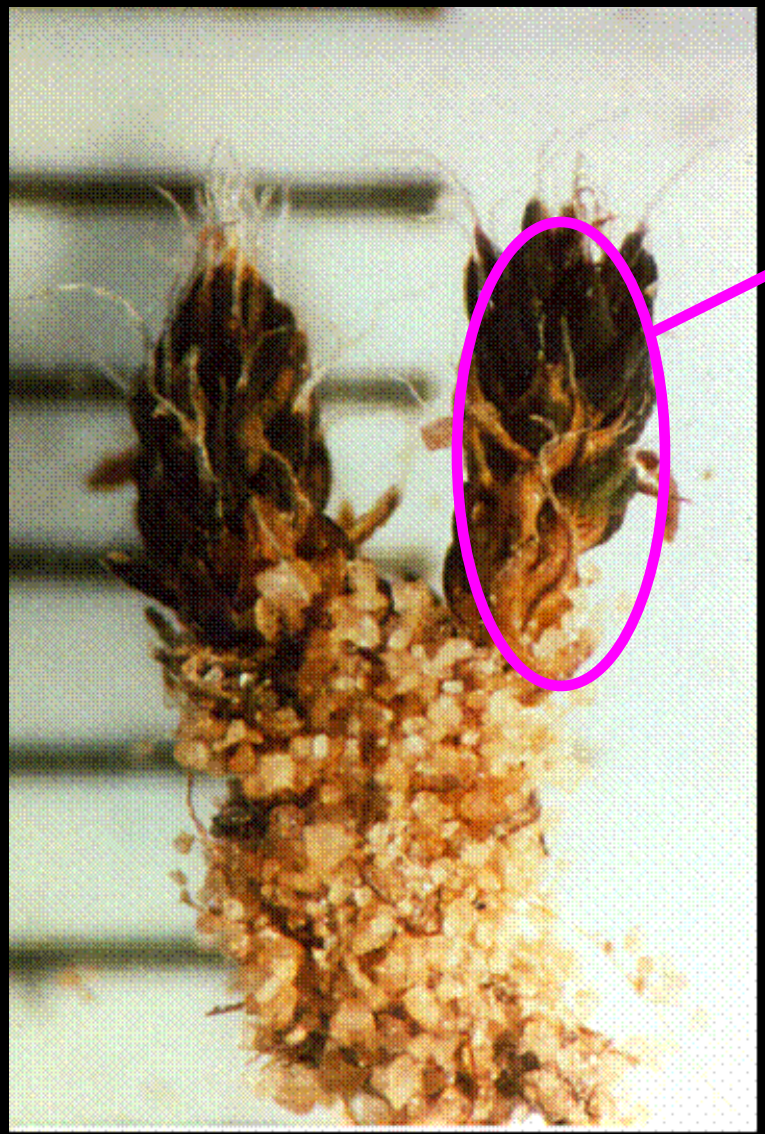
Rosentreter, Bowker, Belnap 2007

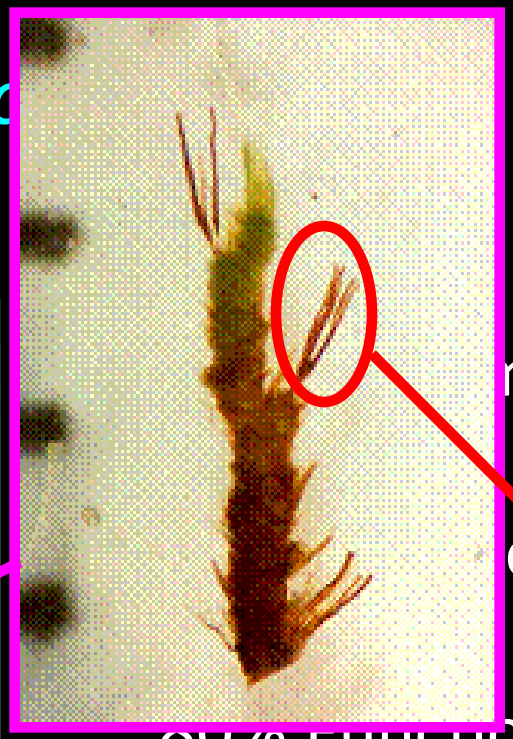
Mosses …. In the desert???

Syntrichia caninervis
Photo: L. Stark

How do they reproduc

Syntrichia caninervis





noss of

Plateau & many

e

80% Function

sterile

14♀: 1♂ Sex R

Bowker et al. 2

A male has to grow this

If that happens AND a fertilization happens, a female has to grow this

Long story, short: *this is a mostly clonal species*

Widespread, may be co-dominant

Vegetative propagation

Occupies stressful environments

Long-term propagule viability

Kind of sounds like a “workhorse” species.

Do mosses have a place in the CPNPP?

The major goals of this effort are to increase the availability of native plant materials and to provide the knowledge and technology required for their use in restoring diverse native plant communities across the Colorado Plateau.

GOAL 1 - Identify Existing and Future Needs for Native Plant Materials for Restoration Purposes on the Colorado Plateau.

GOAL 2 - Develop an adequate supply of diverse, economical, and regionally-adapted native plant materials for restoration efforts on the Colorado Plateau.

GOAL 3 - Identify existing methodologies and work with partners to develop and test new methodologies to ensure successful establishment and persistence of native plant materials.

Totally.

“Identify existing and future needs”

Erosion is often an issue in restoration,

Regionally it has wide-ranging consequences

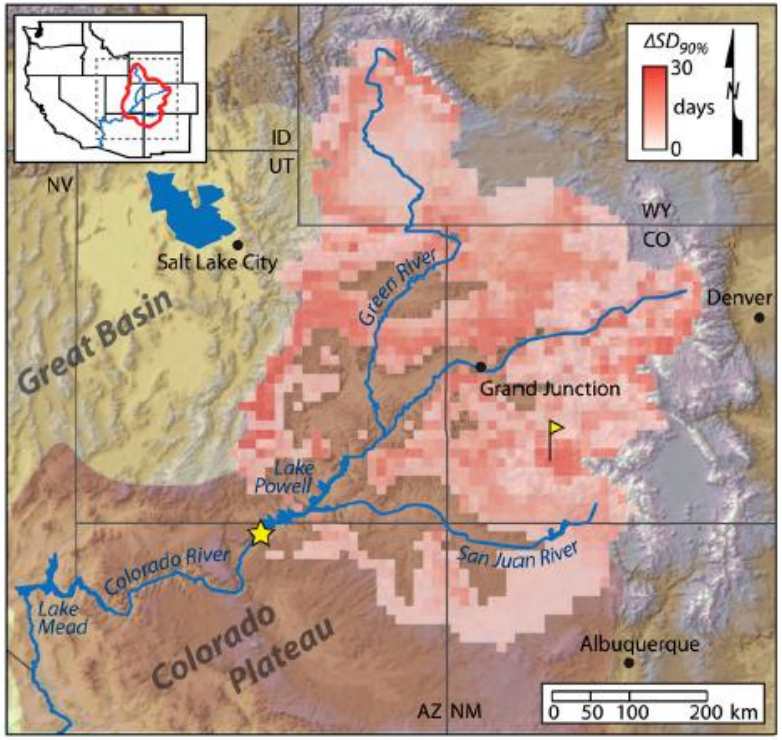


Fig. 1. Overview of Upper Colorado River Basin, and the Colorado Plateau and Great Basin physiographic provinces, overlain with change in date of $\Delta SD_{90\%}$ for elevations above 1,800 m. Star indicates Lees Ferry, AZ and flag indicates SBBSA.

“Identify existing and future needs”

2 years of altered precipitation frequency

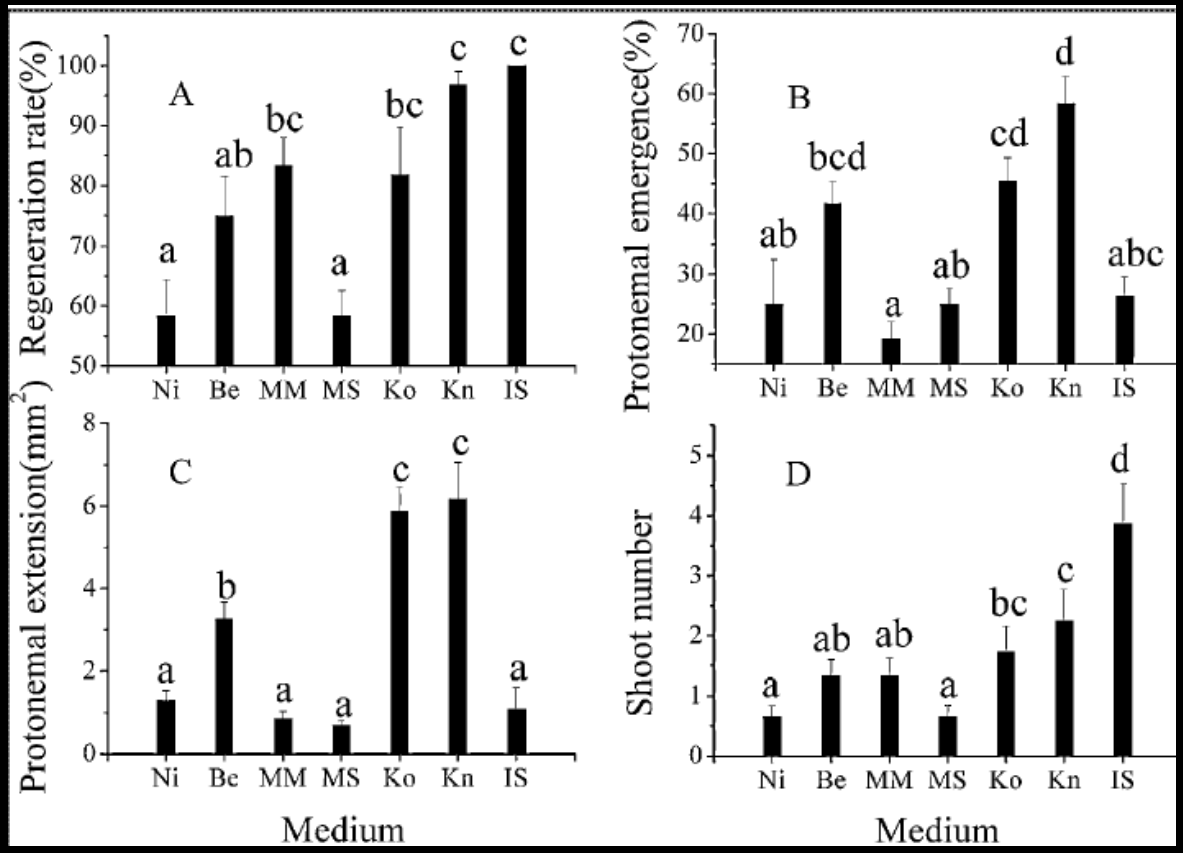
Control = no damage

Doubled summer rainfall frequency = 90% mortality

Zelikova et al. 2011

“Develop and test new methodologies” & “Develop an adequate supply of plant restoration materials”

Syntrichia caninervis in China



Xu et al. 2008 has laid the groundwork, we just have to adapt the method for North American populations

We know…

Optimal growth media
Optimal growth conditions
Best performing type of tissue

2 months in the growth chamber can produce as much biomass as 10 years in the field

We need to know…

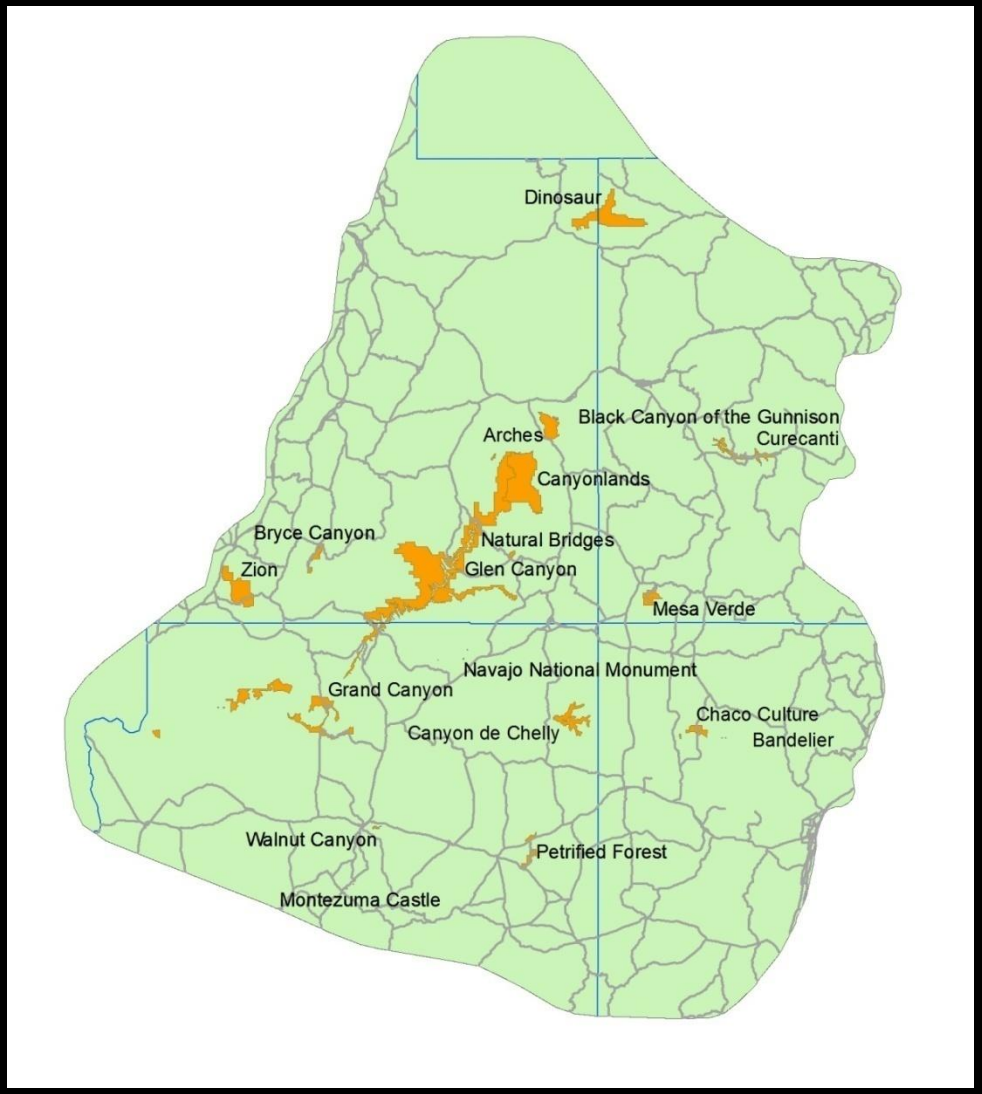
Can we repeat it with North American populations?

Do populations differ in culturability?

Can we similarly grow the closely related species *S. ruralis*?

What are the barriers to reintroducing cultured material into the field?

“Develop….regionally adapted…plant materials”



Project idea

Sample both *S. caninervis* and *S. ruralis* from multiple National Parks across Colorado Plateau ecoregion

Within each park, sample from contrasting soils

Genetically fingerprint

Determine degree of local adaptation, Adaptive variation, environmental correlates with specific gene markers

From this I can envision:

A culture collection from different regions that is always true to the source population.

A system for matching cultures to sites based on adaptive traits (e.g. monsoon tolerant)

“Gametophyte transfer zones”??!!

In summary, mosses…

Prevent erosion and dust emissions, and are susceptible to some climate change scenarios

Can be artificially cultured to produce restoration materials

Present a relatively simple system for producing regionally adapted ecotypes

Therefore they are a good fit with the CPNPP

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